



Public Update Report #1
April 2022 – March 2023

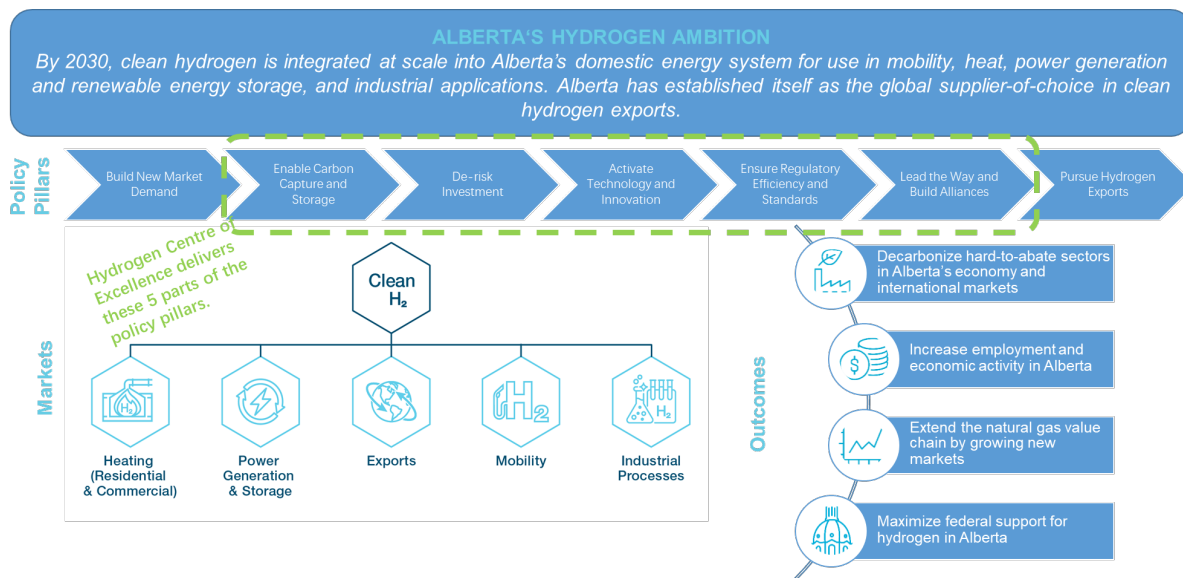
Section 1: Background

Overview of Hydrogen Centre of Excellence and Goals

The Alberta Hydrogen Centre of Excellence (HCOE) is a grant funding provider, testing and service facility provider and a forum for facilitating partnerships to de-risk hydrogen technology development in Alberta. The Hydrogen Centre of Excellence objectives are to:

- Identify technology gaps to broad market adoption of hydrogen,
- Develop and deliver innovation programs to fill the identified technology gaps,
- Provide publicly accessible testing facilities and services, and
- Facilitate partnerships and alliances to de-risk technology and advance projects, and
- Inform the public about the scope, benefits, and deployment of a hydrogen economy in Alberta.

The HCOE is a key component of the Alberta Hydrogen Roadmap, as indicated below:

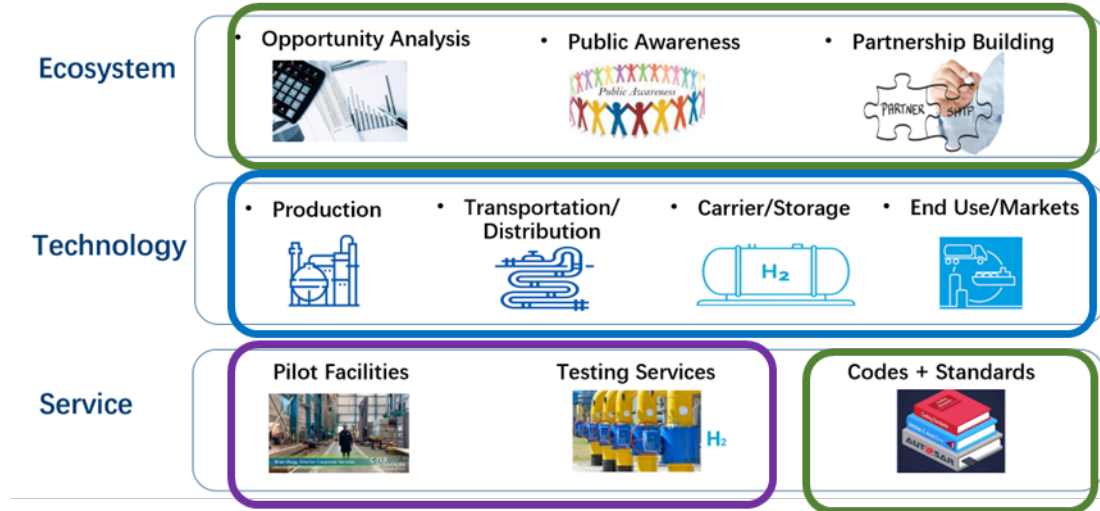


The HCOE is operated by Alberta Innovates with governance from the Government of Alberta.

Scope & Funding Allocations

The HCOE works across the entire value chain of the hydrogen economy, providing support for technology development, ecosystem enhancement, and publicly accessible testing services. \$50 Million has been provided to the HCOE across four fiscal years (Apr 2022 to Mar 2026) according to the following streams as mapped onto the scope diagram below:

Stream	Description	Access	Allocation
Technology & Innovation	Technology development starting TRL 3-6	2 Open Competitions	\$35 M
Capital Facilities	Testing capabilities at InnoTech & C-FER	Direct Application	\$10 M
Services Capacity	Studies, analyses, codes & standards	Continuous Intake	\$4 M
Admin	Administration	N/A	\$1 M



Section 2: Highlights to Date

Technology & Innovation – Competition #1

The HCOE Competition 1 was successfully concluded in the fiscal year. At the intake stage there were 68 proposals submitted with a combined funding request of over \$90M (total project size over \$369M). The Full Proposal stage had 31 applicants with a combined funding request of over \$37M (total project size over \$183M). The HCOE allocated \$20.1M to successful proponents, \$9.4M of which was provided by Natural Resources Canada (NRCAN). While this resulted in lower than budgeted expenditure of the HCOE funds, the matching of contributions by NRCAN is a positive outcome that meets the Hydrogen Roadmap goal of partnering with federal agencies. This enables additional HCOE funds to be allocated towards subsequent competitions and other hydrogen development opportunities in Alberta.

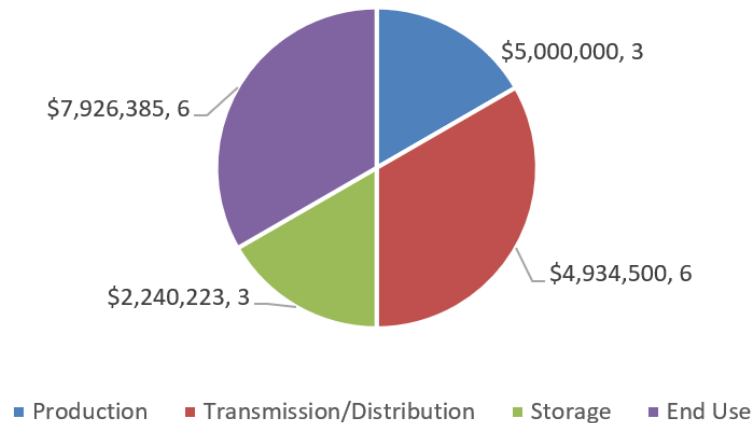
Total project value from all projects approved in 2022-23 is \$131M, for a funding leverage rate of 11:1.

The successful HCOE Competition 1 proponents represent a broad spectrum of the hydrogen ecosystem. The following graphics illustrate this diversity.

The full value chain is well-represented by successful proponents, as shown in Figure 1. Note that the dollars are for the amount requested, and the number that follows represents the number of proposals in that category.

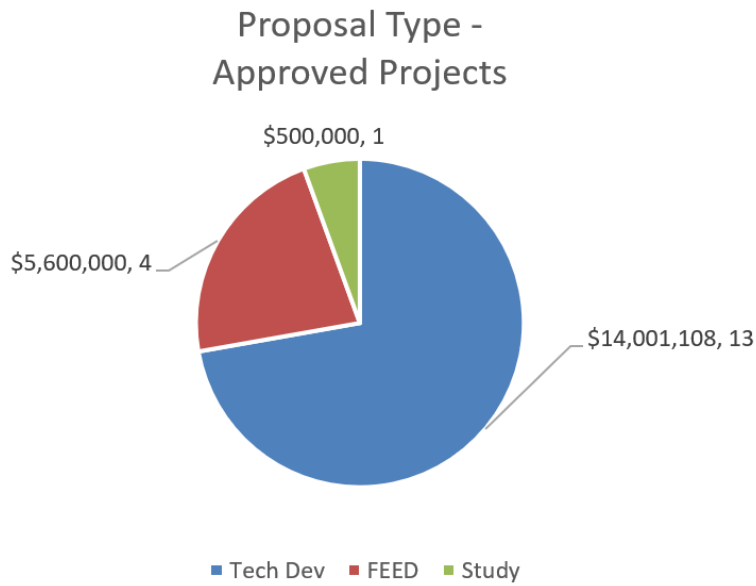
Figure 1: Proposal Distribution by Value Chain

Proposal Distribution by Value Chain - Approved Projects



The successful proponents also represent a range of project types, with the majority being technology development (Figure 2). However, there are several FEED proposals and study proposals from this competition as well.

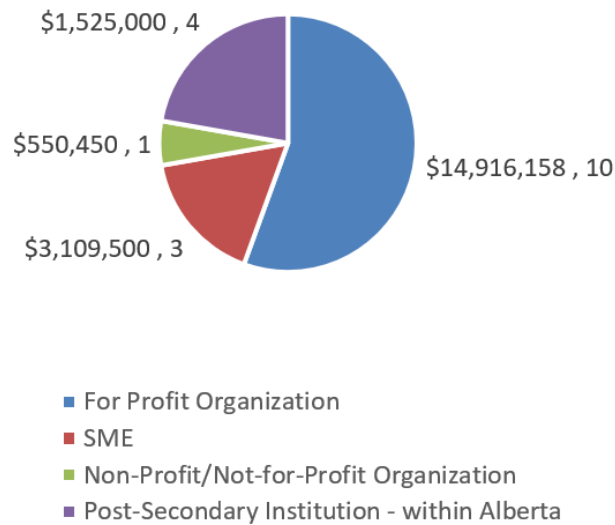
Figure 2: Proposal by Type for HCOE Competition 1 Full Proposal



To further illustrate the diversity of applicants, the full proposal applicants were divided into organization type (for profit, non-profit, small to medium-sized enterprise (SME), post-secondary institution (PSI)), as shown in Figure 3.

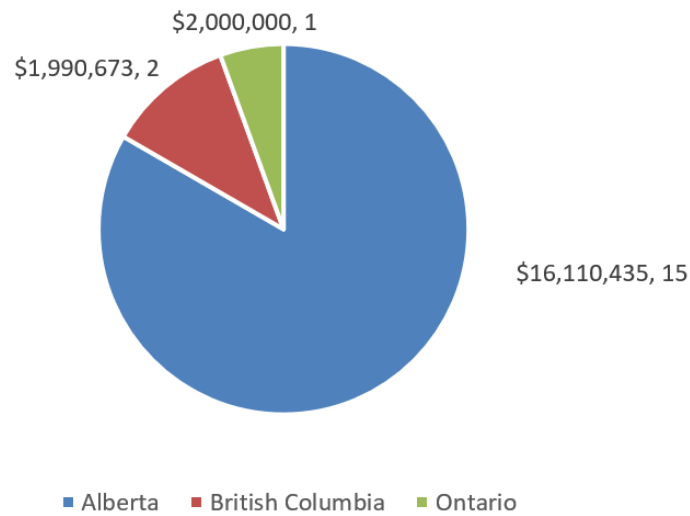
Figure 3: Full Proposal Applicants by Organization Type

Organization Type - Approved Projects



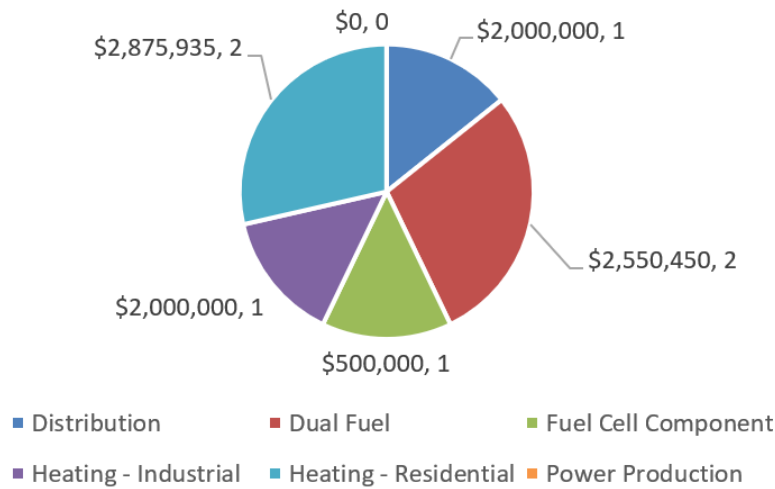
Successful proponents also represent geographic diversity including several from British Columbia and Ontario, as shown in Figure 4.

Figure 4: Successful Proponents by Geographic Base
 Proponents by Location - Approved Projects



Finally, a broad range of end uses for hydrogen were represented within the successful proponent list, as shown in Figure 5.

Figure 5: Successful Proponents by Hydrogen End Use Type
 Sub-Category Distribution - End Use - Approved Projects



Project Summaries for the eighteen projects can be found in the Alberta Innovates Project Library (<https://albertainnovates.ca/impact/funded-projects/>), filtered by program “Advancing Hydrogen – Competition 1”

Technology & Innovation – Competition #2

As of fiscal year-end 2022/23, Competition #2 is yet to launch. However, preliminary conversations indicate high likelihood of partnership with Emissions Reduction Alberta and NRCan, enabling the competition to be bigger (in term of funding available) and broader (coverage of TRL 3-9) than Competition #1.

Capital Facilities

Alberta's strength in developing a hydrogen ecosystem is being expanded through HCOE investments in InnoTech Alberta (InnoTech) (\$3.66M) and C-FER Technologies (C-FER) (\$2.65M) to expand their hydrogen testing facilities. These scopes were approved during fiscal 2022/23 and procurement and construction are well underway. Prairies Economic Development Canada (PrairiesCan) provided \$3M in additional funding towards the C-FER facilities upgrades.

Thus \$6.3M of the \$10M capital facilities budget has been allocated as of the end of fiscal 2022/23. Second proposals from each of InnoTech and C-FER are currently underway, with the expectation that all \$10M will be allocated before the end of fiscal 2023/24.

The enhanced facilities have already captured domestic and international attention, with numerous testing contracts signed and in development.

Services Capacity

Operating on a continuous intake basis, during fiscal 2022/23 three initiatives were approved in the Services Capacity stream:

- Carbon Intensity Standards
- Supply Chain Assessment & Development
- Distributed Hydrogen Production

Seven additional initiatives were in different stages of proposal development/review, with several more in early discussions with HCOE staff.

Public Awareness

A public awareness baseline survey was completed in November 2022 to understand the priority areas for stakeholders and to provide a foundation for measuring progress in subsequent years. The baseline survey revealed that:

- One in 10 Albertans are following news about hydrogen very closely,
- A strong majority believe Alberta is well-positioned to become a global leader in hydrogen development,
- 53% believe that safety is a concern for hydrogen use,
- Approximately 59% believe that hydrogen could have an impact on reducing greenhouse gas emissions,
- Between 53 and 76% of Albertans would be comfortable riding in a train, taking a bus, driving a car, heating their home, using appliances that were fueled by hydrogen, or living near a hydrogen fuel depot,
- 80% want to see business and government work together to develop the hydrogen industry in Alberta,
- 77% believe that the economy will suffer if the transition away from fossil fuels occurs too rapidly, and

- 76% believe that the government should be investing in hydrogen development.

The results of this survey inform the focus areas for a hydrogen public awareness campaign that will be planned in 2023/24 in collaboration with other stakeholders and jurisdictions, and is expected to begin implementation in 2024.

Stakeholder Impact and Involvement

Partnerships under development are both within the government funding organizations as well as industry co-funding discussions and hydrogen ecosystem partnerships. As mentioned, funding has been provided by PrairiesCan for a \$3M contribution to support the build-out of hydrogen testing capabilities at C-FER Technologies' facilities in Edmonton. Similarly, a \$15M funding contribution from NRCan for the HCOE's Competitions 1 and 2 is in place, with the potential for additional funding to support Competition 2 in future fiscal years. Alberta Innovates has received verbal confirmation from Emissions Reduction Alberta that it will co-fund Competition 2 with an additional \$25M, currently planned for launch in Q3 2024.

Funding support from industry is in early stages of discussion. These and other conversations will continue to develop and updates will be provided in subsequent reports.

The HCOE has raised its profile with National and International organizations through several actions. Laura Kilcrease, CEO, and John Zhou, Chief Clean Technology Officer, were in Ottawa discussing HCOE funding support with the Ministry of Innovation, Science and Economic Development (ISED), Natural Resources Canada (NRCan), PrairiesCan, and others. Outcomes from these discussions include the NRCan and PrairiesCan funding mentioned elsewhere in this report, as well as the formation of a Hydrogen Roundtable with the Federal departments, Emissions Reduction Alberta and the HCOE. This Roundtable will focus future efforts on identifying further support needs for the HCOE, collaborative opportunities with other regions across Canada, as well as supports for broad ecosystem deployment of hydrogen in Alberta.

In addition, Bryan Helfenbaum, Executive Director presented on the Hydrogen Centre of Excellence at the Hydrogen Americas Summit in Washington, DC in October 2022. The conference had over 500 in-person attendees, 200 online attendees and represented attendance from 32 countries. Key takeaways from that conference include:

- Canada's current leadership in hydrogen is broadly recognized,
- Recent US incentive programs (in particular the Inflation Reduction Act) may outcompete Alberta's and Canada's efforts unless increased efforts are made,
- Government, academia, technology developers are bullish, industry and financiers are less so,
- Most of the focus is on production and demand, less emphasis on transport and storage, and
- A range of hub designs were observed, but all have the potential to build-out hydrogen infrastructure.

David Van Den Assem, Director, participated in a 10-day hydrogen mission with the Edmonton Region Hydrogen Hub (including Edmonton Global, SBI BioEnergy, Edmonton International Airport) to the Netherlands in October 2022. The tour included 2 R&D facilities, 12 industrial sites and 2 conferences – "Wind to Gas" and "World Hydrogen Congress". The major takeaways from the mission include:

- Financial support for hydrogen demand is critical to build momentum,
- Funding asks from consortia representing the entire value chain helped to build the market,
- Industry expansion and regulatory certainty need to co-develop,
- Ecosystem growth steps start with forming hubs, then connecting hubs, then expanding network,
- Opportunities were identified for AB-based SMEs to expand to the NL, introductions have been made,
- Potential technology collaboration on methane pyrolysis and 100% hydrogen-fueled combustion engines,

- Follow up discussions with a provider of low carbon emissions transit buses is underway to explore opportunities to establish North American manufacturing facilities in Alberta, and
- Interest from several Netherlands contacts in the SBI BioEnergy technology for export to NL.

The HCOE has conducted two Advisory Panel meetings and has populated the Advisory Panel with key stakeholder representatives from government, industry, academia, indigenous communities, and NGOs to ensure direct communication pathways exist. The purpose of the Advisory Panel is to gain insights and feedback from the ecosystem regarding priorities, plans and trends for hydrogen and how to position the HCOE to enable rapid ecosystem development.

The British Columbia Centre for Innovation and Clean Energy (CICE) represents an excellent opportunity to leverage resources and learnings between BC and Alberta and build strong connections between the provinces on technology development and deployment. Alberta Innovates also has representation on BC CICE's advisory panel.

Separately from HCOE initiatives, several ministries have been working on complementary initiatives such as hydrogen fueling stations, hydrogen blending study, and policy evaluation and development.

Training and Upskilling of Highly Qualified Personnel (HQP)

As shown in the quantitative metrics section, the successful projects have project targets attracting and training of between 51 and 79 highly qualified personnel (HQP). These will develop over the project life as the scope is executed and HQP are retained and trained to execute the work. No new Chairs were funded by the Centre in this fiscal year. There are some potential projects in the coming fiscal year that are focused on training and upskilling professionals to serve in the hydrogen field, these will be highlighted in future reports.

Alberta Labour and Immigration, Edmonton Global and many of the Alberta post-secondary institutes have funded the first stage of a labour study to determine the potential labour needs and gaps in Alberta to achieving broad hydrogen deployment. The HCOE has been invited to participate in the update conversations. The results of this study will be released by Alberta Labour and Immigration in the Summer of 2023.

Project Management and Governance

Project management for all funding allocations follows Alberta Innovates' rigorous processes. These include a web-based secure application portal and proposal/project documentation and grant management system ("SmartSimple") and a structured proposal review process that involves two stages ("intake" and "full proposal") with multiple independent reviewers at each stage, with consensus meetings overseen by an independent Fairness Monitor. The Reviews include technical experts from Alberta Innovates, representatives from some of the Ministries that provide oversight to the HCOE, as well as experts from Federal partners. Reviews are documented in the SmartSimple system and consensus meetings occur with all reviewers to ensure that a variety of perspectives are brought to the table and discussed, to ensure the most well-rounded and defensible decisions are made. Successful applicants are required to sign a standard contribution agreement that outlines the terms and conditions of the funding allocation and remedies for performance deviations. Alberta Innovates has continuously improved this process for many years and is adept at successfully managing the process.

Successfully contracted HCOE projects will have an Alberta Innovates staff member assigned to provide active project management to the projects. All staff have relevant technical, business, and strategic expertise, and assist the project teams to achieve positive outcomes and navigate the process of milestone payments. The Clean Resources division, in which the HCOE resides, currently manages over 350 projects and is thus well designed to include the successful HCOE projects.

The HCOE is designed to have substantial governance structure as dictated in the Grant Agreement including the Steering Committee representing key Ministries at the Assistant Deputy Minister level, as well as ERA, and an Oversight Committee representing the same ministries represented at the Deputy Minister level. The inaugural meetings of these Committees took place in May 2022 and the interim meetings occurred in November 2022. The HCOE Secretariat, comprising representatives from HCOE and Alberta Energy, manage the meetings and ensure the deliverables and actions are progressed.

To date, no issues have occurred with project management, project coordination or pivotal changes to the Committees or their mandates. To the contrary, the Committee mandates, Business Plan, and Terms of Reference were finalized in the inaugural meetings. Should any pivots be required, the structures and processes outlined within the existing Terms of Reference, Grant Agreement and/or Alberta Innovates established practices will be used to ensure rapid and conclusive resolution.

Future Research Projects, Goals, Plans and Timelines

The activities for fiscal year 2023-24 will focus on:

- Finalizing Competition 2 planning and execution in coordination with Emissions Reduction Alberta, Natural Resources Canada and possibly others,
- Commence the development of contribution agreements for successful applicants from Competition 2,
- Complete the capital allocation to InnoTech and C-FER to support globally recognized hydrogen testing capabilities in Alberta,
- Conduct a gap analysis of codes and standards relevant to Alberta, coordinating with municipal and provincial governments and standards organizations,
- Initiate projects to fill key gaps relevant to Alberta that are not already being addressed, or will not be addressed in a timeline that meets the needs of Alberta's economy,
- Continue to develop additional critical studies within the "Services Capacity" funding stream,
- Coordinate HCOE activities with key hydrogen-related planning and development activities within the Alberta Government to ensure a seamless "one window to government" experience for Alberta businesses and citizens,
- Support the development and delivery of the Government of Alberta's future financial support of hydrogen initiatives in the province as needed,
- Continue to develop co-funding and funding leverage opportunities with industry, federal funders and ERA,
- Deeper engagement with key post-secondary institutes and relevant ministries on filling gaps in education and training for Alberta's hydrogen workforce,
- Completion of the communications strategy for public awareness,
- Development and implementation of a communications action plan,
- Support the development of industry-led Centres of Excellence across the province,
- Continued facilitation of partnership building within the ecosystem to enable hydrogen integration into the energy system, including initiatives such as the "5000 vehicle challenge" and the Alberta Motor Transport Association Road Show, and
- Integrate the HCOE into the Edmonton and Calgary Region Hydrogen Hubs, and other hubs as they develop to ensure continuity and exposure to HCOE programming and expertise.

Section 3: Quantitative Metrics

Hydrogen-Focused Outputs						
Measure Delivered	Target (#)*			Actual (#)*		Brief Description or Name of Output
	Apr 1, 2022 – Mar 30, 2023	Apr 1, 2023 – Mar 30, 2024	Apr 1, 2022 – Mar 30, 2026	Apr 1, 2022 – Mar 31, 2023	Cumulative since Apr 2022	
New Policies Informed/ Influenced	0	11	22	0	0	No metrics measurable in year 1
Practices Informed/ Influenced	0	22-32	45-54	0	0	No metrics measurable in year 1
Field Pilots/ Demonstrations	1	1	12	1	1	Metrics limited to ATCO salt cavern storage pilot project currently underway
Technologies in Development	13	13	26	13	13	Competition 1 and Services Capacity contracted by Mar 31
New Products/ Services Created	0	4	20-26	0	0	No metrics measurable in year 1
Patents/ Records of Invention Filed	0	10-12	29-38	0	0	No metrics measurable in year 1
Publications Published (include name of journal in description section)	0	10-15	37-46	0	0	No metrics measurable in year 1

Most of the projects were contracted just prior to March 31, 2023, so progress on executing scope was not demonstrable for most projects. There were some that plan to scale up their products created and implement pilot projects through the course of the funding window, these are reflected in the table above. It is anticipated that subsequent reports will have additional data to share as milestones are completed and progress is made on executing the respective scopes of work.

Training and Attracting Talent					
Type of HQP	Target Trained (#)*			Actual Trained (#)*	
	Apr 1, 2022 – Mar 30, 2023	Apr 1, 2023 – Mar 30, 2024	Apr 1, 2022 – Mar 30, 2026	Apr 1, 2022 – Mar 31, 2023	Cumulative since Apr 2022
Students Trained (M.Sc., Ph.D., Postdoc)	0	22	44	0	0
Sector HQP Trained	0	33	67	0	0
Totals	0	55	111	0	0

Similarly, the contracting timing prevented meaningful hiring and training opportunities in this fiscal year. However, it is anticipated that as projects commence, hiring and training will be key activities and these metrics will show significant changes in the coming fiscal year.

Job Creation	
Actual New Jobs Created from Project (cumulative since Apr 2022) (# FTE)	Competition 1, Services Capacity projects contracted for March 31, and Capital

	Funding programs commenced. No reportable metrics as of March 31.
Projected New Jobs Created from Future Deployment (# range)	8,783 to 14,152

Similarly, job creation is expected to follow contracting and will be reported in upcoming reports as milestones are completed and metrics are reported.

GHG Emissions Reduction

Description	Emission Type	Quantity	Unit
GHG Emissions Reduction for the Reporting Year 2022	All	0	Tonnes CO2e
Annual Projected GHG Emissions Reduction in 2035	All	Approximately 17 MT	Tonnes CO2e

As projects have just commenced at the end of fiscal year 2022-23, no emissions reductions were reported. However, projections for future GHG reductions were provided and are collated in the table above. Subsequent reports will have project GHG emissions data. Estimates from the combined projects in the portfolio are anticipated to be approximately 17 MT/y by 2035. These estimates are subject to change based on the success rate of technologies in development, their market penetration rate once commercialized, and the carbon intensity of inputs to hydrogen production by 2035.